

## **GSHWG ARAC Fast Track Report - FAR 25.963 (e) Fuel Tank Access Covers**

### **1. What is the underlying safety issue addressed by the FAR/JAR?**

Fuel tank access covers have failed in service due to impact with high speed objects such as failed tire tread material and engine debris following engine failures. Failure of an access cover on a wing fuel tank may result in the loss of hazardous quantities of fuel which could subsequently ignite. In addition, prolonged exposure to a fire could cause sufficient damage to some fuel tank access covers designs to allow fuel leakage and subsequent ignition.

### **2. What are the current FAR and JAR standards?**

#### **FAR 25.963(e), Amendment 25-69**

“(e) Fuel tank access covers must comply with the following criteria in order to avoid loss of hazardous quantities of fuel:

- (1) All covers located in an area where experience or analysis indicates a strike is likely, must be shown by analysis or tests to minimize penetration and deformation by tire fragments, low energy engine debris, or other likely debris.
- (2) All covers must be fire resistant as defined in part 1 of this chapter.”

#### **AC 25.963-1, dated 7/29/92**

### **1. PURPOSE**

This advisory circular (AC) sets forth a means of compliance with the provisions of Part 25 of the Federal Aviation Regulations (FAR) dealing with the certification requirements for fuel tank access covers on turbine powered transport category airplanes. Guidance information is provided for showing compliance with the impact and fire resistance requirements of FAR 25.963(e).

### **2. RELATED FAR SECTIONS**

The contents of this AC are considered by the FAA in determining compliance of the fuel tank access covers with FAR 25.963(e). Section 121.316 also requires each turbine-powered transport category airplane operated in air carrier or commercial service after October 30, 1991, to meet the standards of FAR 25.963(e).

### 3. BACKGROUND

Fuel tank access covers have failed in service due to impact with high speed objects such as failed tire tread material and engine debris following engine failures. Failure of an access cover on a wing fuel tank may result in the loss of hazardous quantities of fuel which could subsequently ignite.

### 4. IMPACT RESISTANCE

a. All fuel tank access covers must be designed to minimize penetration and deformation by tire fragments, low energy engine debris, or other likely debris, unless the covers are located in an area where service experience indicates a strike is not likely. The rule does not specify rigid standards for impact resistance because of the wide range of likely debris which could impact the covers. The applicant should, however, choose to "minimize penetration and deformation" by testing covers using debris of a type, size, trajectory, and velocity that represents conditions anticipated in actual service for the airplane model involved. There should be no hazardous quantity of fuel leakage after impact. The access covers, however, need not be more impact resistant than the contiguous tank structure.

b. In the absence of a more rational method, the following criteria should be used for evaluating access covers for impact resistance.

(1) Covers located within 30 degrees inboard and outboard of the tire plane of rotation, measured from center of tire rotation with oleo strut in the nominal position, should be evaluated. The evaluation should be based on the results of impact tests using tire tread segments equal to 1 percent of the tire mass traveling at airplane rotation speed ( $V_R$ ), and distributed over an impact area equal to 1 1/2 percent of the total tread area.

(2) For turbine powered airplanes, covers located within 15 degrees forward of the front engine compressor or fan plane measured from center of rotation to 15 degrees aft of the rearmost engine turbine plane measured from center of rotation, should be evaluated for impact from small fragments (shrapnel) with energies referred to in AC 20-128, Design Considerations for Minimizing Hazards Caused by Uncontained Turbine Engine and Auxiliary Power Unit Rotor and Fan Blade Failure, issued 3/9/88. The covers need not be designed to withstand impact from high energy engine fragments such as engine rotor segments or propeller blade fragments.

### 5. FIRE RESISTANCE

a. All fuel tank access covers must be fire resistant. The definition of fire resistant, as given in Part 1 of the FAR, means the capacity to withstand the heat associated with fire at least as well as aluminum alloy in dimensions appropriate for the purpose for which they are used. For the purpose of

complying with this requirement, the access cover is assumed to be subjected to fire from outside the fuel tank. The fuel tank access covers need not be more fire resistant than the contiguous tank structure.

b. Access covers, not as fire resistant as contiguous tank structures, should be tested for five minutes using a burner producing a 2000°F. flame. The test burner and procedures for instrumentation and calibration should be as defined in AC 20-135, Powerplant Installation and Propulsion System Component Fire Protection Test Methods, Standards, and Criteria, issued 2/6/90. The test cover should be installed in a test fixture representative of the actual installation in the airplane. Credit may be allowed for fuel as a heat sink if covers will be protected by fuel during all likely conditions. The maximum amount of fuel that should be allowed during this test is the amount associated with reserve fuel. Also, the static fuel pressure head should be accounted for during the burn test. There should be no burn-through or fuel leakage at the end of the tests; although damage to the cover and seal is permissible.

#### JAR 25.963(g), Amendment 93-1 to Change 13

"(g) Fuel tank access covers must comply with the following criteria in order to avoid loss of hazardous quantities of fuel:

(1) All covers located in an area where experience or analysis indicates a strike is likely, must be shown by analysis or tests to minimise penetration and deformation by tyre fragments, low energy engine debris, or other likely debris.

(2) Reserved

(See ACJ 25.963(g))"

#### ACJ 25.963(g), Amendment 93-1 to Change 13

"Fuel Tanks: General (Acceptable Means of Compliance)

See JAR 25.963(g)

1. *Purpose.* This ACJ sets forth an acceptable means of showing compliance with the provisions of JAR-25 dealing with the certification requirements for fuel tank access covers. Guidance information is provided for showing compliance with the impact resistance requirements of 25.963(g).

2. *Background.* Fuel tank access covers have failed in service due to impact with high speed objects such as failed tyre tread material and engine debris following engine failures. Failure of an access cover on a wing fuel tank may result in the loss of hazardous quantities of fuel which could subsequently ignite.

3. *Impact Resistance*

a. All fuel tank access covers must be designed to minimise penetration and deformation by tyre fragments, low energy engine debris, or other likely debris, unless the covers are located in an area where service experience or analysis indicates a strike is not likely. The rule does not specify rigid standards for impact resistance because of the wide range of likely debris which could impact the covers. The applicant should however, choose to "minimise penetration and deformation" by testing covers using debris of a type, size, trajectory, and velocity that represents conditions anticipated in actual service for the aeroplane model involved. There should be no hazardous quantity of fuel leakage after impact. The access covers, however, need not be more impact resistant than the contiguous tank structure.

b. In the absence of a more rational method, the following criteria should be used for evaluating access covers for impact resistance.

i. Covers located within 15° inboard and outboard of the tyre plane of rotation, measured from the centre plane of tyre rotation with oleo strut in the nominal position, should be evaluated. The evaluation should be based on the results of impact tests using tyre tread segments having width and length equal to the full width of the tread, with thickness of the full tread plus casing. The velocities used in the assessment should be based on the highest speed that the aircraft is likely to use on the ground. Generally, this will be the higher of the aircraft rotation speed ( $V_r$ ) and the flapless landing speed.

ii. Covers located within 15° forward of the front compressor or fan plane measured from the centre of rotation to 15° aft of the rearmost turbine plane measured from the centre of rotation, should be evaluated for impact from small fragments (shrapnel). The covers need not be designed to withstand impact from high energy engine fragments such as rotor segments."

*Note: FAR 121.316 requires each turbine-powered transport category airplane operated in air carrier or commercial service after October 30, 1991, to meet the standards of 25.963(e). This requirement however was considered to be beyond the scope of the tasking to the GSWHG, and has therefore not been discussed. JAR-26 currently does not contain an equivalent retro-active requirement.*

### **3. What are the differences in the standards and what do these differences result in?**

FAR 25.963(e)(1) and JAR 25.963(g)(1) are identical.

FAR 25.963(e)(2) requires fuel tank access covers to be fire resistant. There is no such requirement in JAR-25. This results in additional compliance demonstration for FAR 25 compared to JAR-25.

### **4. What, if any, are the differences in the means of compliance?**

The guidance given on tire debris is different in AC 25.963-1 from ACJ 25.963(g), in terms of tire fragment spread angle, tire fragment size and tire fragment speed. When applying the guidelines of ACJ 25.963(g) the result is a much higher impact energy of the tire fragments compared to application of the guidelines of AC 25.963-1, although the tire fragment spread angle defined in ACJ 25.963(g) is smaller than the angle defined in AC 25.963-1.

AC 25.963-1 contains guidance on showing compliance with the fire resistance requirement of FAR 25.963(e)(2). Because JAR 25.963(g)(2) does not require fuel tank access covers to be fire resistant, ACJ 25.963(g) does not contain any guidance on this subject.

#### **5. What is the proposed action?**

The proposed action is, for the rule, to harmonize on a revised wording of FAR 25.963(e)(2) / JAR 25.963(g)(2). This proposal removes the words "fire resistant" from the rule, and replaces it by the definition of fire resistant of part 1, allowing that the fuel tank access covers need not be more resistant to fire than an access cover made from the base fuel tank structural material.

For the advisory material, for tire debris, harmonization is achieved by adopting the current AC 25.963-1 guidance on tire fragment spread angle and mass, but adopting the current ACJ 25.963(g) guidance of tire fragment speed.

For the advisory material, for engine debris, harmonization is achieved by adopting an additional definition of engine debris to be used in the absence of relevant data.

For the advisory material, for fire resistance, harmonization is achieved by adopting revised acceptable means of compliance to resistance to fire.

#### **6. What should the harmonized standard be?**

**[4910-13]**

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR Part 25**

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